International Journal of Fauna and Biological Studies

Available online at www.faunajournal.com

International Journal of Fauna And Biological Studies

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Seasonal Variations of Length-Weight Relationship *Pampus chinensis* (Euphrasen, 1788) Chinese Silver Pomfret Collected from Karachi Fish Harbour

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Abstract
The present study was carried out to assess length - weight and condition factor of *Pampus chinensis* (Euphrasen, 1788) from Karachi Fish Harbour. The largest (360 mm) and heaviest (230 g) were collected in post-monsoon. Condition Factor (CF) of *Pampus chinensis* varied from 0.4908 to 0.9621 in all individual. The lowest mean condition (0.6615 ± 0.04) was measured in monsoon. The lowest mean length (276.46±5.53) was measured in pre-monsoon. The maximum mean weight of fish, 184.54± 2.97 was obtained in monsoon. The lowest mean weight of 160.71± 4.57 was recorded in pre-monsoon. The relationship between length and weight of *Pampus chinensis* was given by an equation W = 0.4943253 × L $^{1.438}$ for all individuals. Statistical analysis (ANOVA) was performed to test the differences between seasons to determine the differences. The relationship between length and weight of *Pampus chinensis* length, weight and condition factor were insignificant in all seasons (p > 0.05).

Keywords: Length-Weight Relationship, *Pampus chinensis*, Chinese Silver Pomfret, Karachi Fish Harbour.

1. Introduction
P. chinensis is benthopelagic and amphidromous fish (Riede, 2004) [17]. They occur seasonally singly or in small schools over muddy bottoms and prey on mainly ctenophores, salps, jellyfish, zooplankton and small benthic organisms (Last, 1997) [6]. Therefore it may be suggested that *P. chinensis* is also very good bio-indicator for monitoring heavy metals in coastal waters.

As fish is an important and high protein source of food for people all over the world (Pawar and Sonawane, 2013) [15], this in itself imposes a need for detailed investigation of metal pollution and control of their levels (Patin, 1982) [13]. *P. chinensis* is carnivour fish (Last, 1997) [6] and plays important role in food chains. Chinese silver pomfret are consumed in fresh (Last, 1997) [6].

Length–length relationships are also important for comparative growth studies (Moutopoulos and Stergiou, 2002) [9]. The length-weight relationships of fish are important for converting length observations, obtained for example from underwater visual census methods, into weight estimates for, for example, biomass estimates (Froese, 1998) [2]. The condition factor also expresses the physical and environmental conditions of fish (Le Cren, 1951) [7]. It is used for comparing the condition, fatness, or well-being of fish (Tesch, 1968) [19].

Karachi Harbour is the most important fishing area in Pakistan (Siyal *et al.*, 2013) [18]. In addition, of the numerous industrial, sewage and agricultural wastes reach the Karachi Coastal area through some rivers that are heavily polluted in several places. The dumping of wastes in the coast provides a significant source of heavy metal input (Khattak *et al.*, 2012; Mukhtar and Hannan, 2012) [5, 10].

The some properties of *Pampus* species was in investigated by researchers (Mustafa, 1999; Pauly, 1996; Dutta *et al.*, 2012; Lee *et al.*, 1992; Hussain *et al.*, 1997) [11, 14, 1, 8].

The objective of the present research is to provide Length – Weight relationships data for *Pampus chinensis* from the Karachi Harbour, Pakistan.

Materials and Methods
The 72 sample was collected from Katrachi Fish Harbour during Pre-monsoon, mon-soon, and post-monsoon seasons in the year of 2013. Twenyfour sample was selected in each season.

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The Karachi coastline is between latitude 24°53'N and longitude 67°00'E, and lies in the Northern boundary of Arabian Sea.

The fish samples were measured the fork length (FL) to the nearest 0.1 cm and body weight (BW) to the nearest 0.1 g. The relationship between FL and BW was calculated separately with log10-transformed data (Le Cren, 1951) [7]. The condition factors (CF) of fish was determined using the formula (W x L^{-3}) x 100 (Ricker, 1975) [16], where W= body weight and L= body length. The values of constant 'a' and 'b' were estimated from the log transformed values of length and weight for equation, log W = log a + b log L. or power model, W = a.L^b, to test the cube model of fish growth (Le Cren, 1951) [7].

Statistical analysis (ANOVA) was performed to test the differences between seasons to determine the differences.

Results

The length, weight, condition parameters and the length-weight relationships of the selected species are shown in Table 1 and Table 2 according to seasons. Mean FL (mm, min-max) were founded 276.46 (240-325) for pre-monsoon. Mean BW (g, min-max) and mean CF (value, min-max) were founded 160.71 (132-204), and 0.77 (0.59-0.96) for pre-monsoon. Mean FL (mm, min-max) were founded 303.5 (290-340) for monsoon. Mean BW (g, min-max) and mean CF (value, min-max) were founded 184.54 (168-218), and 0.66 (0.55-0.69) for monsoon. Mean FL (mm, min-max) were founded 285.0 (260-360) for post-monsoon. Mean BW (g, min-max) and mean CF (value, min-max) were founded 167.25 (146-230), and 0.73 (0.49-0.83) for post-monsoon.

Length and weight (min-max) of the fish was 240-360 mm and 132-230 g. The maximum mean length of (303.50±2.91) *Pampus chinensis* in monsoon. The lowest mean length (276.46±5.53) was measured in pre-monsoon (Table 1). The maximum mean weight of fish, 184.54± 2.97 was obtained in monsoon. The lowest mean weight of 160.71± 4.57 was recorded in pre-monsoon (Table 1).

The Condition Factor of *Pampus chinensis* varied from 0.4908 to 0.9621 in all individual. The lowest mean condition (0.66 ± 0.06) was measured in monsoon (Table 1). The maximum mean condition of fish 0.77 ± 0.04 was obtained in pre-monsoon.

The differences between length, weight and condition factor were insignificant in all seasons ($p < 0.05$). The differences between length, weight and condition factor were insignificant in pre-moonson – post-moonson ($p < 0.05$).

Length–weight relationships were calculated using the data of all fish samples. The relationship was W = 0.04943253 × L$^{1.438}$ for all individuals. The relationship was W = 0.06448330 × L$^{1.3907}$ for pre-monsoon. The relationship was W = 0.01596722 × L$^{1.6366}$ for monsoon. The relationship was W = 0.05871858× L$^{1.4067}$ for post-monsoon. (Table 2 and Figure 1). Length–weight curves for all individual are drawn according to seasons in Figure 1. The b value is often 3.0 and generally between 2.5 and 3.5. As the fish grows, changes in weight are relatively greater than changes in length, due to approximately cubic relationships between fish length and weight. The b values in fish is species specific and varies with sex, age, seasons, physiological conditions, growth increment and nutritional status of fish (Bagenal and Tesch, 1978). The slope (b) values of the length–weight relationship in both gender is found as a 1.438 for Pampus chinensis from Karachi Harbour.

(a)

(b)

Table 1: Mean fork length (FL, mm), mean Body weight (BW, g), mean condition factor (CF) for seasons of *Pampus chinensis* from Karachi Fish Harbour.

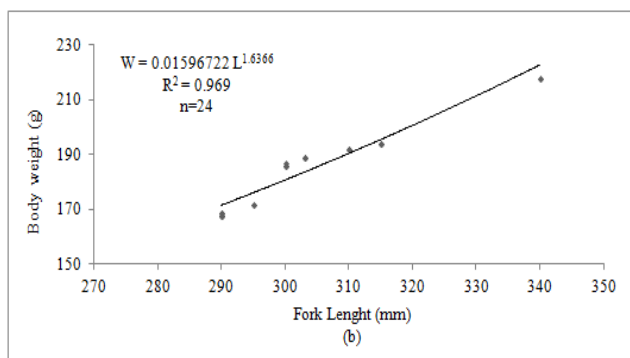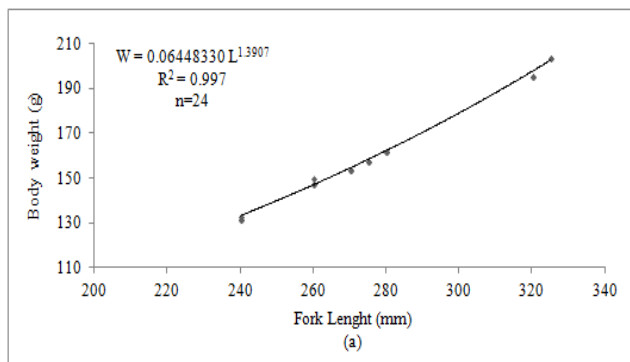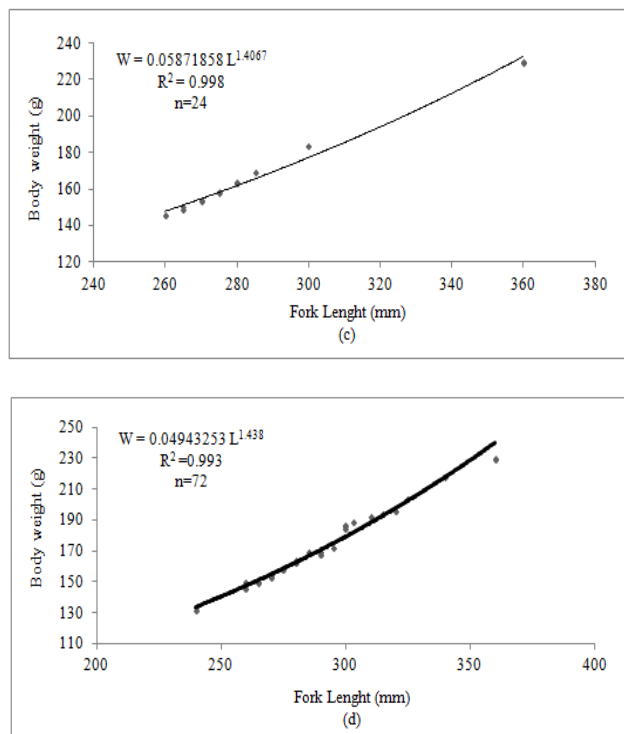| Seasons	N	FL±SE (min.-max. mm)	BW±SE (min.-max. g)	CF±SE (min.-max.)
Pre-Monsoon	24	276.46± 5.53 240-325	160.71± 4.57 132-204	0.77± 0.04 0.59-0.96
Monsoon	24	303.5± 2.991 290-340	184.54± 2.97 168-218	0.66± 0.06 0.55-0.69
Post-Monsoon	24	285.00± 6.33 260-360	167.25± 5.35 146-230	0.73± 0.02 0.49-0.83
General	72	288.32± 3.22 240-360	170.83± 2.78 132-230	0.72± 0.01 0.49-0.96

Table 2: Length and Weight relationship in *Pampus chinensis* from Karachi Fish Harbour.

Seasons	Length and Weight Equations	Correlation
Pre-Monsoon	W = 0.06448330× L$^{1.3907}$ Log W = -1.1906 + 1.3907 log L	0.997
Monsoon	W = 0.01596722 × L$^{1.6366}$ Log W = -1.7968 + 1.1.6366 log L	0.969
Post-Monsoon	W = 0.05871858× L^{14067} Log W = -1.2312 + 1.4067 log L	0.998
General	W = 0.04943253 × L$^{1.438}$ Log W = -1.3069 + 1.438 log L	0.993

Fig 1: Length–weight relationships in (a) pre-monsoon, (b) monsoon, (c) post-monsoon and (d) all season for *Pampus chinensis*

Discussion

Some previously reported results in other location of the world mostly indicate variation in the b values. Mustafa (1999) [11] also reported *Pampus chinensis* in in the Bay of Bengal as a=0.03120; b = 2.983 for all individuals; *Pampus argenteus* in in the Bay of Bengal a= 0.04230, b= 2.929 for all individuals. Pauly (1999) also reported *Pampus argenteus* in Kuwait a= 0.01660, b= 2.503; Dutta *et al.* (2012) [1] reported *Pampus argenteus* in Northern Bay of Bengal a= 0.02770, b= 2.840; Lee *et al.* (1992) [8] reported Pampus argenteus in Korean waters a =0.03450, b= 3.000; Hussain *et al.* (1977) reported *Pampus argenteus* in Kuwaiti waters a=0.03930, b=3.058.

Pati (1981) [12] reported $W = 0.007345 \times L^{2.82}$ for *Pampus chinensis* and Pati (1981) [12] reported $W = 0.01340 \times L^{2.53}$ (mature male) and $W = 0.009523 \times L^{2.69}$ (mature female) for *Pampus argentus.*

This variation can be affected by sex, gonad maturity, health, season, habitat, nutrition, environmental conditions (such as temperature and salinity), area, degree of stomach fullness, differences in the length range of the caught specimen, and fishing gear (Tesch, 1971; Froese, 2006) [3].

Conclusion

According to these obtained data, it should be follow the growth and length and weight relationship of *Pampus chinensis* from Karachi Coastal. This study can be of help to fishery managers of the Karachi Coastal, because of the lack of documentation about length-weight relationship of the selected species of the Karachi Coastal.

Acknowledgements

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